Summary of the Fertilizer Results at Indian Head, 1972

R. N. McIver

In general the 1972 growing season was more favourable for the production of cereals than forage. There was a good reserve of soil moisture to supplement the seasonal precipitation for the cereal crops. Forage crops depend on early spring moisture. In 1972 the precipitation during April and May was 2.68", about the same as the 76-year average, but most of it occurred in light, ineffective showers, less than .25". Although average precipitation occurred during June and July, the total for 1972 was 13.69" compared to a 76-year average of 17.09"

Cereals

Crop rotations with and without a grass-legume mixture and fertilizer have been compared for a number of years. The yield of wheat on fallow in a rotation which includes a grass-legume mixture has been maintained at a high level. There has been no response to P even though there is only a medium level of available P in the soil. In the fallow, grain or fallow, grain, grain cropping sequences the soil is low in available P and the response correlates closely with the present soil test bench marks.

Manure has been applied since 1946 at 6, 9 and 12 tons per acre during the fallow year in a 3-year rotation of fallow, wheat, wheat. A treatment with 40 lb of 11-48-0 was included in the test. The levels of available P and NO_3-N are shown in Table 1.

The level of available P in the soil has increased by the application of manure even in the 12-24" depths. There has been little increase in the NO_3-N which is usually high in the fallow and low or very low in the stubble but this varies from year to year.

The yields of wheat on fallow and stubble are compared in Fig. 1 and 2 respectively. From 1948-52 to about 1958-62 there was a small increase in the yield of wheat on fallow as the rate of

TABLE I

The level of Nitrate Nitrogen and available Phosphorus in the soil with and without manure 1972

Available P (average of fallow and stubble)

	Available P (lb/acre)		
Soil Depth	Check	9 ton/acre	12 ton/acre
0 - 6"	11	23	25
6 - 12"	4	12	11
12 - 24"	6	10	12

Nitrate Nitrogen

	NO_3-N (lb/acre)					
Soil Depth	Check		9 ton/acre		12 ton/acre	
	fallow	stubble	fallow	stubble	fallow	stubble
0 - 6"	40	5	22	6	42	6
6 - 12"	13	4	11	5	22	4
12 - 24"	17	5	19	5	26	7
TOTAL	70	14	52	16	90	17

manure increased. Since 1958-62 there has been a gradual increase in the difference between the treatments. During the period 1968-72 the increase was 10.7 bu/acre with 12 tons of manure compared to an increase of 4.0 bu/acre with 6 tons of manure. When 40 lb of 11-48-0 was applied along with the 9 tons of manure there was little or no additional increase in yield from the 11-48-0 until 1961-65. Since then the yield increase has been similar to 12 tons of manure. Forty pounds of 11-48-0 per acre alone increased the yield 2 to 3 bushels per acre until 1962-66 and since then the response has gradually increased to about 5 bushels.

A smaller but similar pattern of response was obtained with some of the treatments in the yield of wheat after wheat. Small increases were obtained until 1958-62 and then a marked increase occurred in

Figure I

Average Increase Of Wheat On Fallow With Manure

In A Fallow, Wheat, Wheat Rotation 1948 - 1972

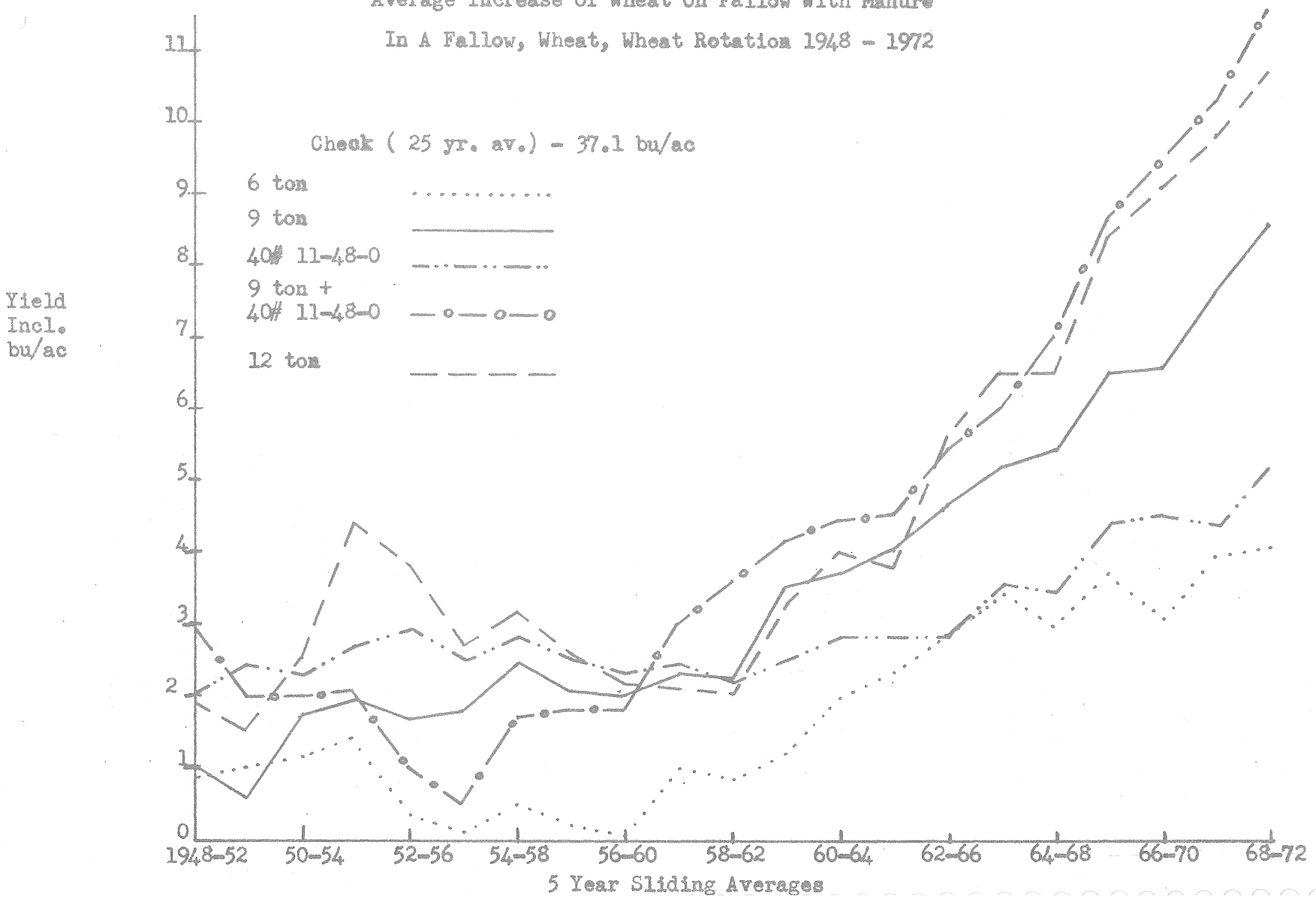
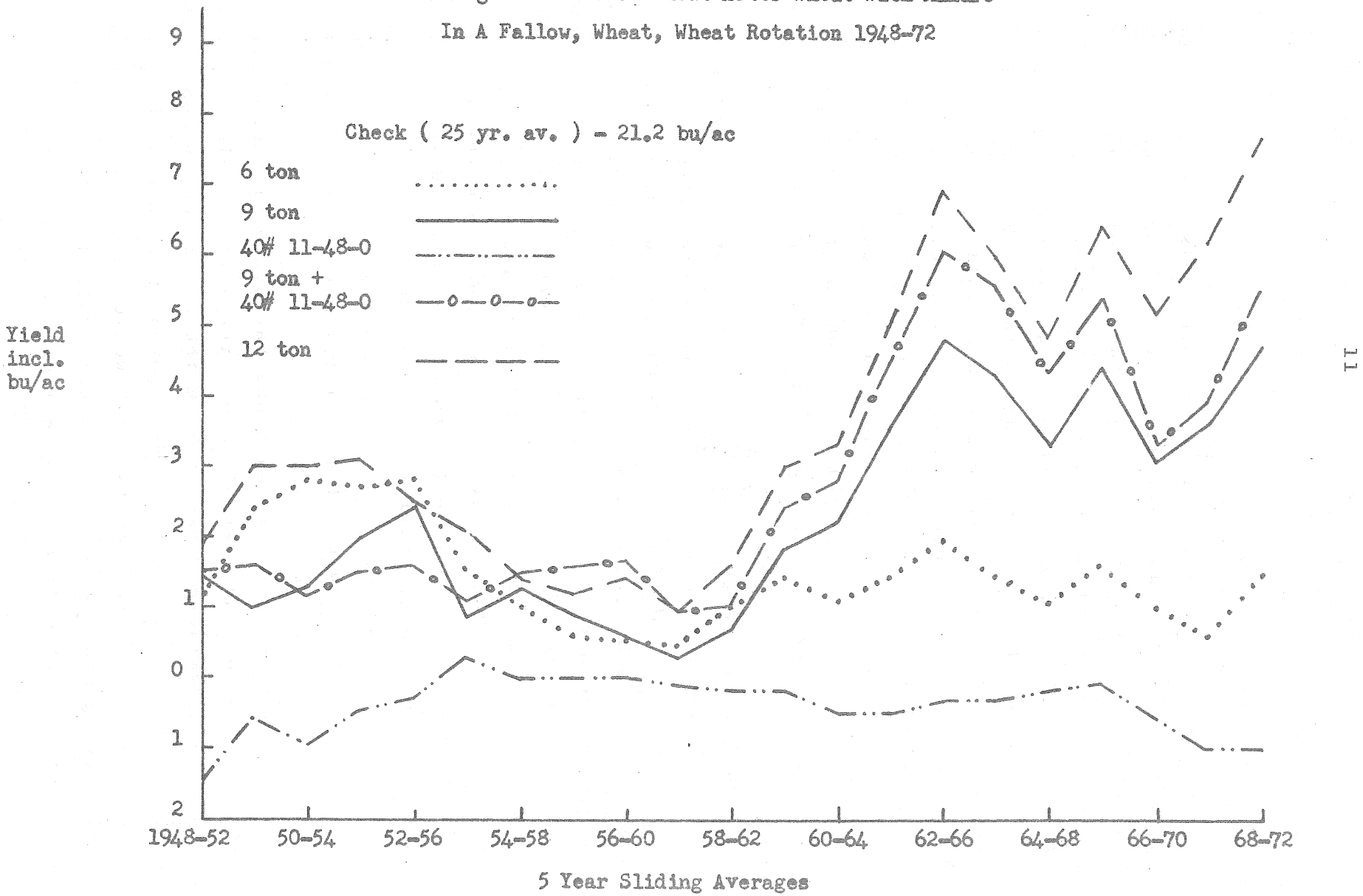


Figure II

Average Increase Of Wheat After Wheat With Manure

In A Fallow, Wheat, Wheat Rotation 1948-72



the response to 9 and 12 tons of manure. Six tons of manure increased the yield 1 to 2 bushels throughout the period. There was a small but consistent decrease in the yield with 40 lb of 11-48-0. However, a small but consistent increase in yield occurred when 40 lb of 11-48-0 was applied to the previous crop along with the 9 tons of manure.

Rates of 11-48-0 from 20 to 100 lbs per acre in 20 lb increments have been applied to wheat on fallow in fallow, wheat, wheat sequence since 1945. The treatments increased the level of available P in the soil but not the NO_3-N. In the 0 - 6" depth of soil the available P was check - 7 lb, 40 lb of 11-48-0 14 lb, and 100 lb of 11-48-0 31 lb per acre. The application of 100 lb of 11-48-0 per acre every third year for 27 years increased the available P from very low to high.

The yields are shown in Figure III. The first few years of the test there was little difference in the yield between 40, 60, 80 and 100 lb per acre. Difference began to occur about 1948-52. The increase in yield with 40 and 60 lb has remained relatively constant throughout the period 1945-72. During the 5 year periods 1966-70 to 1968-72 the increase with 20 lb has been similar to 40 and 60 lb. The 80 and 100 lb rates continued to increase the yield, particularly the latter rate. The 100 lb of 11-48-0 increased the available P in the soil from very low to high and still continued to increase the yield more than the lighter rates of 11-48-0.

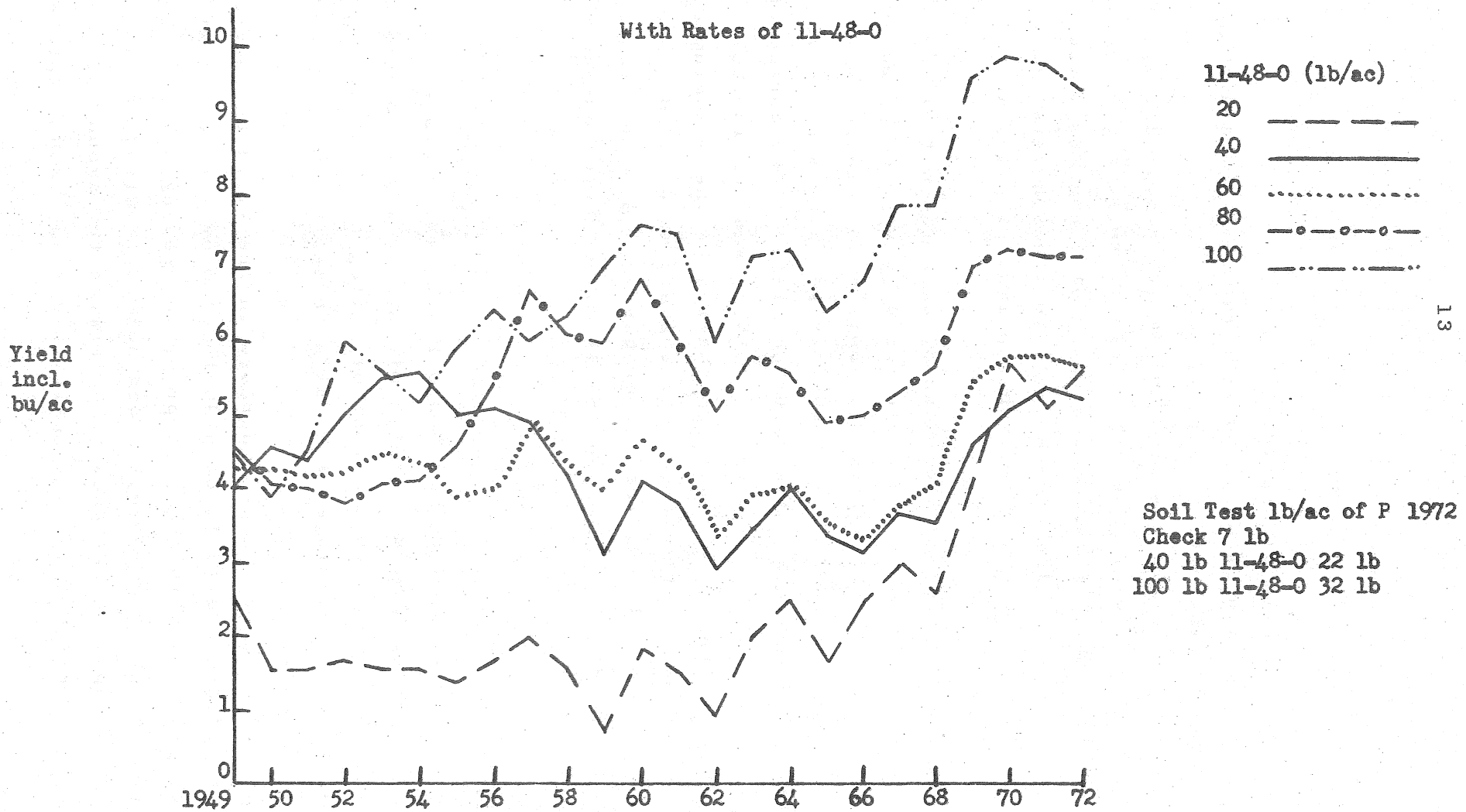
These tests indicate that eventually it may be necessary to also consider the management and cropping history of the fields in making soil test recommendations.

The response of wheat, oats and barley to nitrogen were compared on Oxbow and Ryerson loam. The soil contained an average of 12 lb of available P per acre in the 0 - 6" depth and 36 lb of NO_3-N in the 0 - 24" depth. Forty pounds per acre of P_2O_5 was applied to all the treatments which would provide an adequate level of P. Nitrogen at 20 lb per acre was applied with the seed and broadcast. Additional rates of nitrogen were also broadcast. The

Figure III

Yield Increase Of Wheat On Fallow

With Rates of 11-48-0



yields are shown in Figure IV.

Twenty pounds of N placed with the seed was twice as efficient as broadcast. The optimum rate of N for wheat was about 20 lb and the increase in yield was about 5 cwt per acre. The optimum rate for oats was 40 lb of N and the yield increase was about 12 cwt. The optimum rate for barley was 60 lb of N and the yield increase was about 19 cwt. The present soil test bench marks indicate that 15 lb of N should be applied, the optimum rate for wheat but not oats or barley.

Fall and spring applications of ammonium nitrate and fall applications of ammonium nitrate and urea were compared for 7 years, 1966-72. In 1972 the spring application of ammonium nitrate yielded 33.4 bushels compared to 23.5 bushels per acre for the fall application. Although the 7 year average yield of the spring application was 2.6 bushels more than the fall there was considerable variation from year to year. The fall application of the ammonium nitrate was superior to urea. It yielded 5.7 bushels more in 1972 and averaged 1.6 bushels more during the 7 year period. Although the average increase was small it was consistent and occurred during 6 of the 7 years.

Forage

Several combinations of N and P were incorporated with the soil prior to seeding a brome-alfalfa mixture in 1970. Superimposed on this were broadcast applications of nitrogen. The yield of dry matter and the percentage of alfalfa in the sward are shown in Figures V and VI.

There was a very sharp increase in the yield and decrease in the percentage of alfalfa when 40 lb of N or more along with P_2O_5 was incorporated with the soil prior to seeding. This trend was also evident with the annual broadcast applications of N. Soil and plant samples were taken to determine the amount of N and P in the various treatments. The analysis has not been completed.

Figure IV
Average Response Of Wheat, Oats and Barley on Stubble
to Rates of N
(40 lbs/ac P_2O_5 With all Treatments)

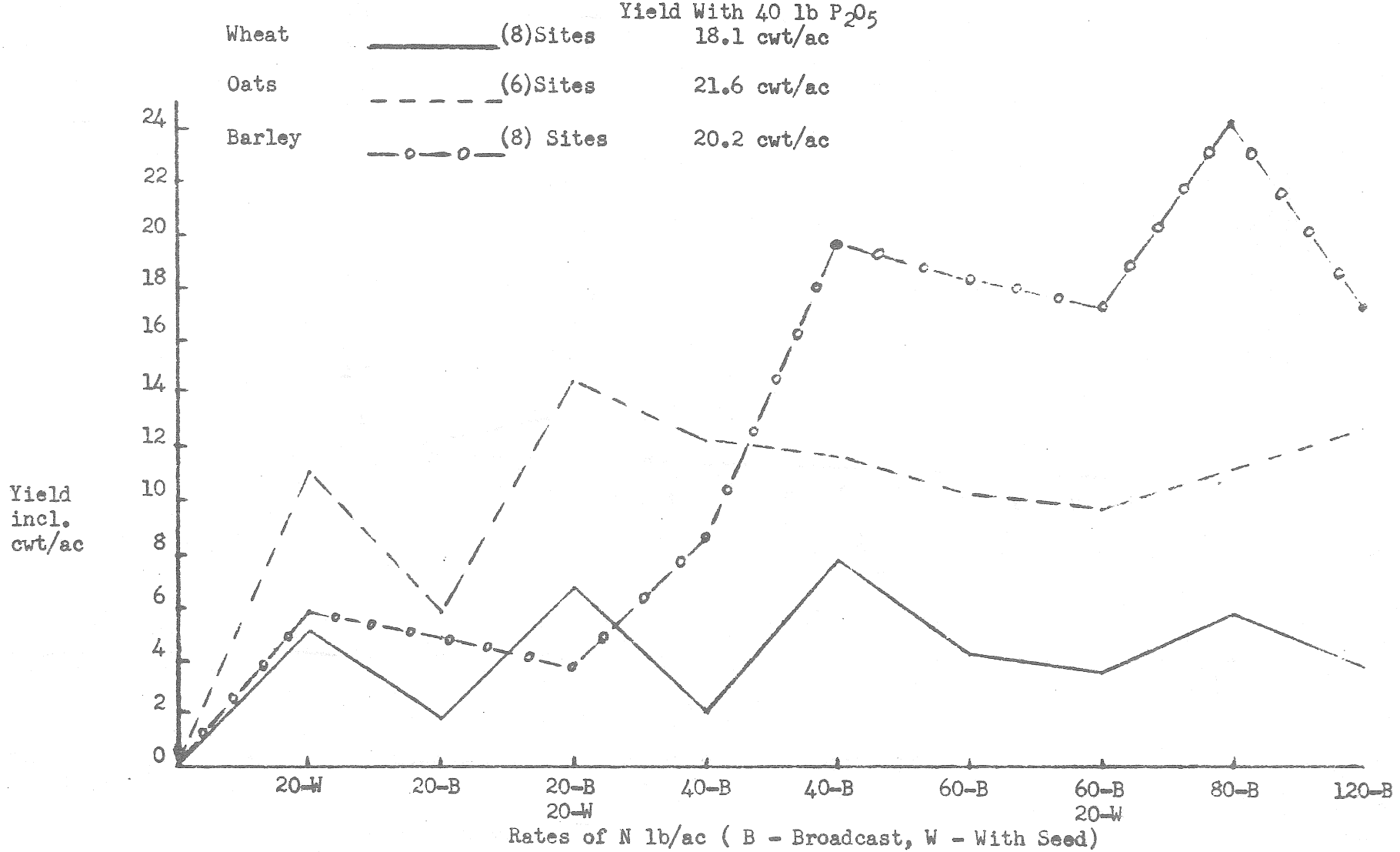


Figure V
Fertilized Brome and Alfalfa - 2 Yr. Av. 1971-72
Yield of Brome and Alfalfa (Dry Matter)

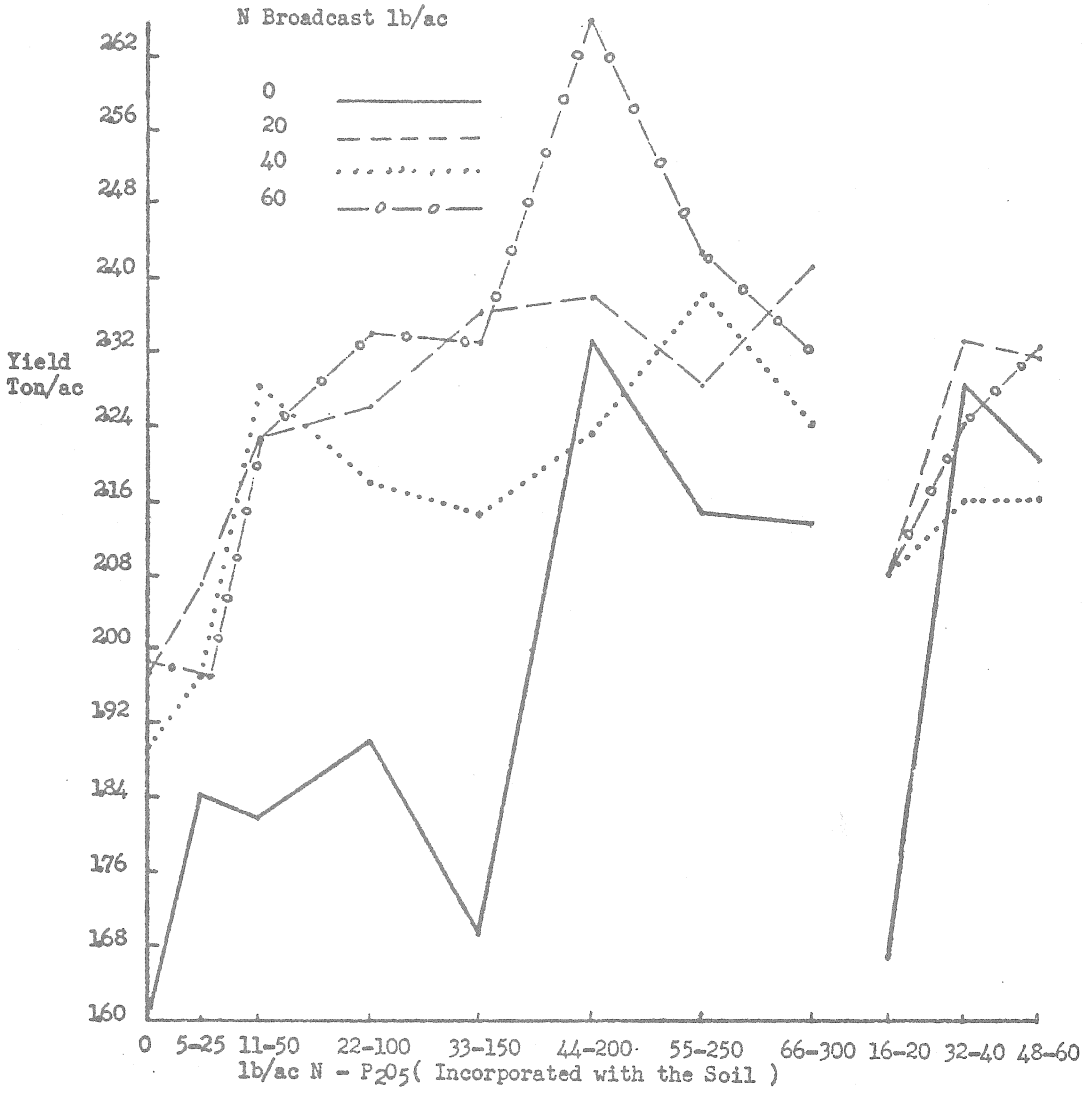
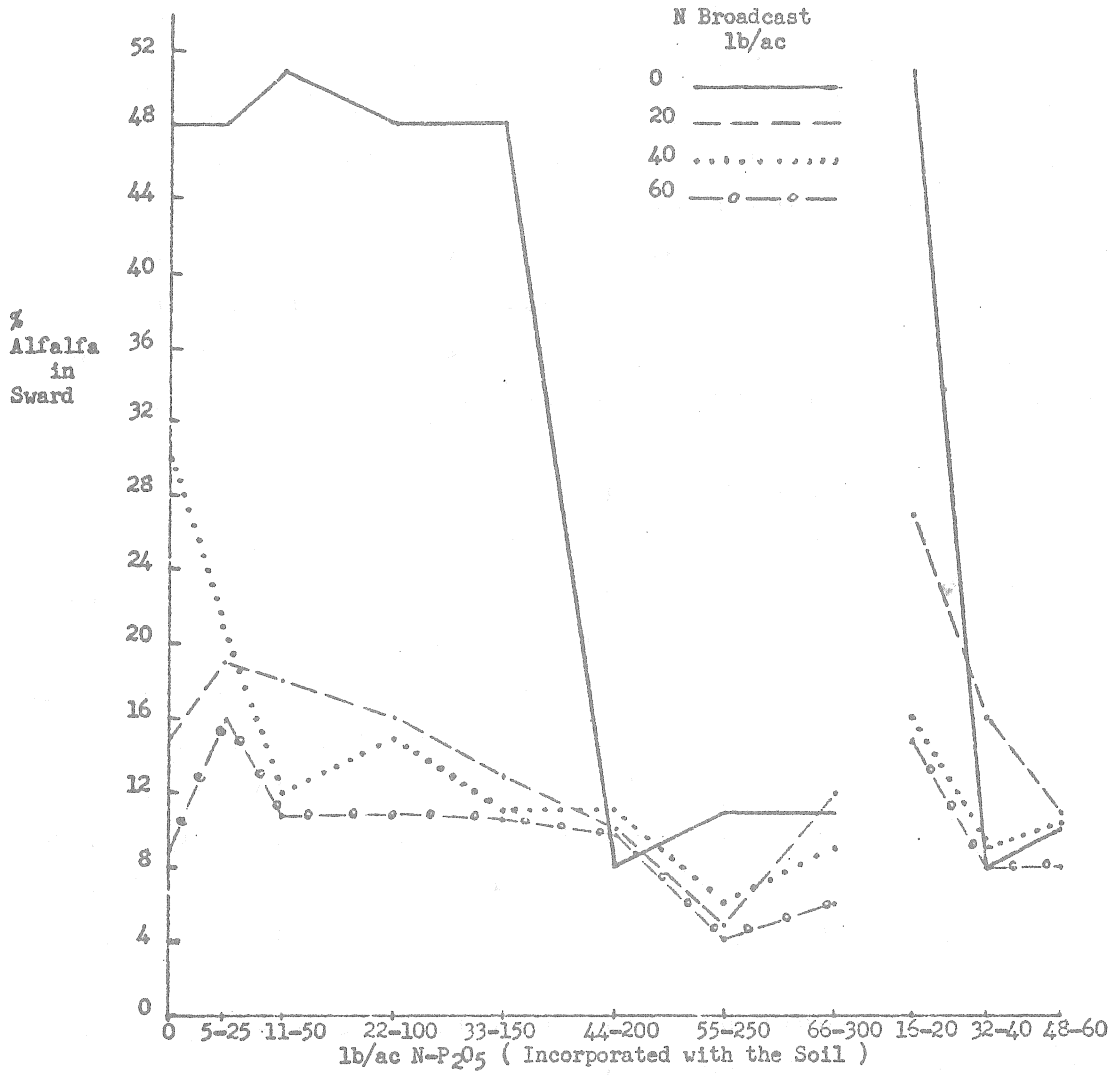


Figure VI
Fertilized Brome and Alfalfa - 1972
% Alfalfa



In another group of tests several rates of N alone and in combination with P were broadcast for 3 successive years to an established stand of brome and alfalfa at two locations. The soil was a Ryerson loam and it tested low in NO_3-N and very low to low in available P each year. The yields of dry matter were determined during each of these three years, 1969-71. The yields were taken again in 1972 to determine the residual response. At one location there was no response to N or N and P during 1969-71 and there was no residual response in 1972. The yields of dry matter at the other location are shown in Figures VII and VIII.

The residual response to P_2O_5 in 1972 was almost as high as the average for the 3 years that the fertilizer was applied. The residual response to N was considerably less than the 3 year average. The residual response increased the economic value of rates that were previously marginal.

The yield increase with N and P at 20 to 30 lb per acre, the most economic rates in the 3 year average, were marginal but when the residual response was included these rates were quite economical.

In another test various rates of N and P with and without S were broadcast on a one year old stand of alfalfa on Waitville loam. The soil contained 15 lb of NO_3-N, 17 lb of SO_4-S in the 0 - 24" depth and 3 lb of available P in the 0 - 6" depth. The yield of dry matter increased from 2.08 to 2.40 ton/acre as the rates of N and P_2O_5 increased from 0 to 40 lb per acre. The yield also increased from 2.08 to 2.33 ton/acre as the rate of S increased from 0 to 40 lb per acre.

The response of established stands of brome and alfalfa to broadcast applications of N and P has been quite variable. Even on soils testing very low to low the response usually is of marginal economic value.

Figure VII
Brome and Alfalfa Response to Rates of P_2O_5
RYERSON
(Dry Matter)

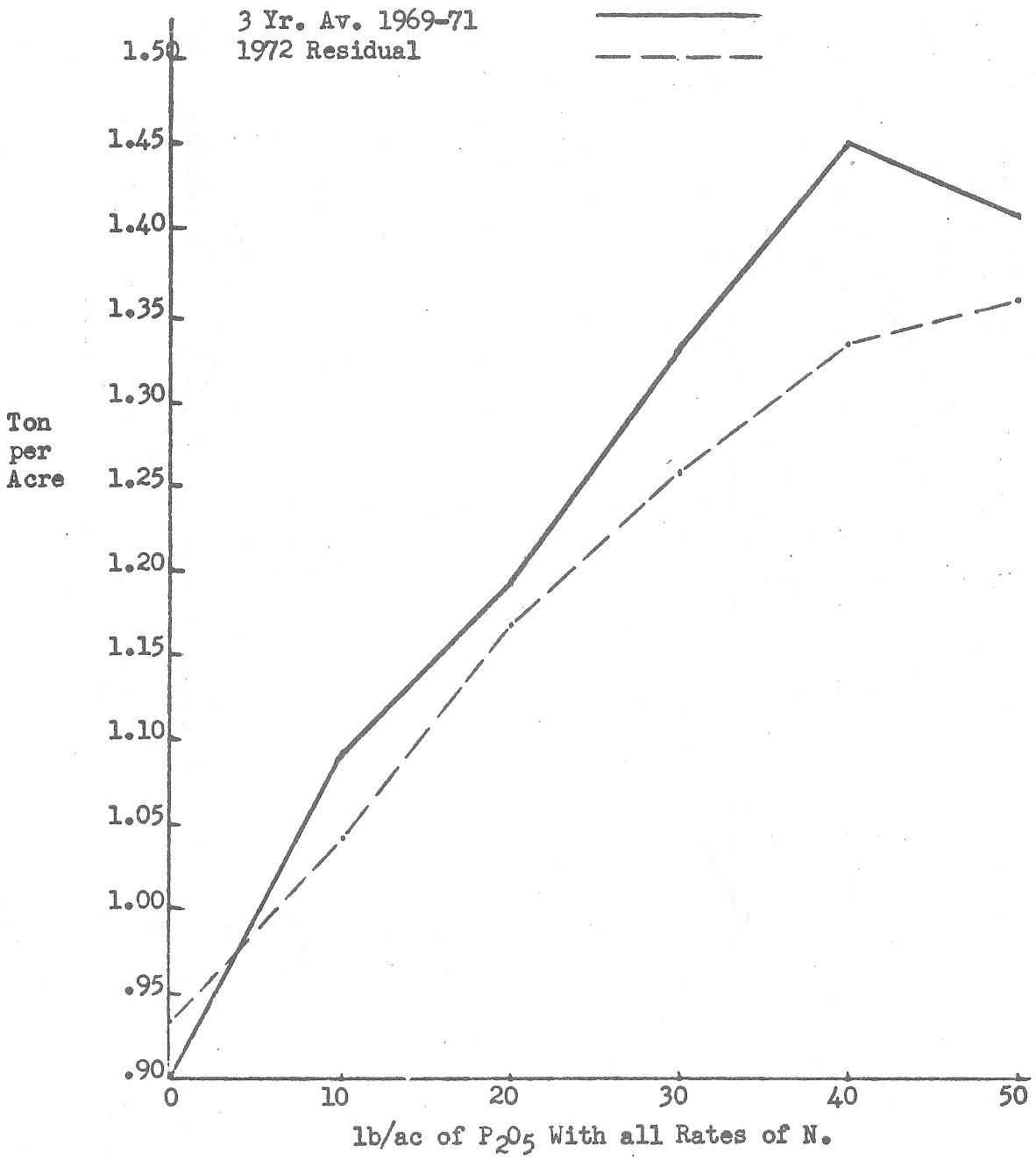


Figure VIII
Brome and Alfalfa Response to Rates of N.
RYERSON
(Dry Matter)